

Early nutrition and health – Indian perspective

Mahtab S. Bamji

India has the highest incidence of childhood malnutrition in the world. Almost 30% babies in India are born with low birth weight and are doomed to adverse consequences, including degenerative diseases in later life. Comparison of putative factors between regions (South Asia and Sub-Saharan Africa), countries within South Asia and select states within India, suggests neglect of women throughout their life as the main causative factor. A multidisciplinary approach inclusive of food, nutrition, environmental and health security with local planning and social engineering to improve the health and nutrition status of women throughout their life is suggested. The three 'A' strategy of awareness (among the community and the providers), access and affordability needs to be developed. A paradigm shift from child survival to child health, literacy to education and skills for women, emphasis on pregnant and lactating women to a life-cycle approach, and aid to empowerment through livelihood is needed.

HEALTH of the people is the most important indicator of development of a nation, and nutrition is an important determinant of health; environment and genetics being the others. The term malnutrition includes both under-nutrition, and over-nutrition. In the high-mortality developing countries, under-nutrition ranks first and together with micronutrient deficiencies (iron, zinc and vitamin A) contributes to over 24 percentage points of disease burden, as judged by the loss of disability associated life years (DALYs)^{1,2}. Since nutritional deficiencies do not occur in isolation, contributions from other deficiencies, particularly B-complex vitamin deficiencies (folic acid, riboflavin), which are rampant, may have been overlooked³. It is therefore clear that diet and nutrition have tremendous potential for improving health.

Within all sub-regions of the world, there is a strong positive correlation between poverty and child under-nutrition. People living on less than \$1 per day, are generally at two- to three-fold higher relative risk of child underweight compared to people living on more than \$2/day¹.

Malnutrition in children – The Asian enigma

South Asia has the dubious distinction of having the highest prevalence of malnutrition in children – higher than even Sub-Saharan Africa which in many ways is lesser developed than South Asia (Figure 1). Ramalingaswamy *et al.*⁴ refer to this as the Asian enigma. Nearly half of all malnourished children in the world and a large proportion of malnourished adult women reside in the

few South Asian countries – India being the largest^{4,5}. Researchers have tried to investigate this phenomenon by comparing the two regions for a variety of putative factors that can contribute to childhood malnutrition.

The two regions have similar purchasing power as judged by GNP⁵. Food security as judged by the percentage of undernourished seems to be better in Asia than in Africa⁶. Infant and child mortality in Sub-Saharan Africa is higher than in South Asia⁵. Higher infant and child mortality would eliminate the more malnourished children from the statistics, giving a false picture of lesser incidence of malnutrition. However, researchers feel that this can explain only seven-percentage points difference in the incidence of malnutrition between the two regions. Education levels are also comparable in the two regions. However, female literacy as percentage of male literacy

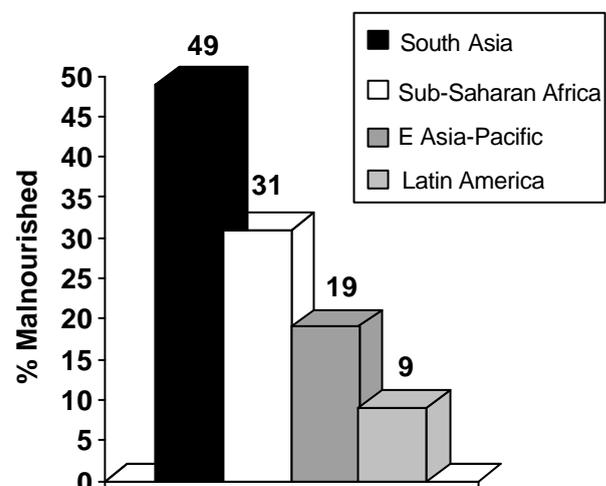


Figure 1. Malnutrition in preschool children – the Asian enigma (after ref. 5).

Mahtab S. Bamji is at the Dangoria Charitable Trust, 1-7-1074, Musheerabad, Hyderabad 500 020, India.
e-mail: mbamji@hd2.dot.net.in

is higher in Africa⁵. Factors like availability of safe drinking water, sanitation and immunization are also unlikely to play a role, since South Asia has done better both on drinking water and immunization fronts, though sanitation is better in Africa⁵. Other factors like the rich-poor disparity and level of destitution due to it are similar in the two regions⁴. Though vegetarianism is more common in India, vegetarians do consume milk and some, even eggs. Vegetarianism is more a matter of economic necessity rather than choice, because large segments of the population even in India do consume meat (mutton, chicken, fish), if available at affordable prices. On the other hand, large segments of African population may not be able to afford meat. Greater degree of government indifference to nutrition in South Asian countries is also an unlikely factor, since these countries do have specific programmes beamed on maternal and child health, and even nutrition. The earlier concept of genetics and need for different growth standards has been debunked. Genetic potentials of population for growth are not very different. With higher crude birth rate in Africa, the possibility of more children with higher birth order contributing to greater degree of malnutrition in South Asia also does not apply.

It may be pointed out that the observation of Ramalingaswamy *et al.*⁴ made in 1996 applies even today, as seen from more recent data.

The problem of low birth weight

Ramalingaswamy *et al.*⁴ put their finger on the incidence of low birth weight as the distinguishing factor. While over 30% of babies in South Asia are born with low birth weight, the percentage is half of this (15%) in Africa and less than 10% in other developing regions like East Asia-Pacific and Latin America. Low birth weight can be due to pre-maturity or intrauterine growth retardation. Both have a complex aetiology, but maternal malnutrition, maternal age (adolescent pregnancy), infections and lack of antenatal care are the major causes which contribute to intrauterine growth retardation.

Neglect of women

Several factors point to the neglect of women in India and other South Asian countries, except perhaps Sri Lanka. These include (i) high maternal mortality (over 450 per 100,000 live births), (ii) low sex ratio (number of females per 1000 males), (iii) early marriage and pregnancy, (iv) malnutrition and low weight gain during pregnancy, and (v) poor literacy.

Maternal mortality

Maternal mortality is very high in both the regions. Asia and Africa contribute to 87% of maternal deaths (death

from causes related to child birth). Malnutrition, infections, toxæmia, very young or very old age, small stature, unattended labour, are among the major causes of maternal deaths. Increased frequency of antenatal check-up has been shown to improve the outcome of pregnancy.

Low sex ratio

South Asia has the dubious distinction of having the lowest sex ratio (number of women per 1000 men). Thus, the sex ratio in India is only about 950 and is declining⁷. In some of the northern states which are relatively more economically developed, the sex ratio is less than 900. What is particularly alarming is the declining juvenile sex ratio, suggesting elimination of females before they are born or worst still, female infanticide. Intrauterine sex determination technology has worked against women. In South Asia, the preference for males is particularly due to the social custom of dowry for women at the time of marriage. Women have a poor social, economic and educational status in the society and lack the privilege of decision-making. Desire for a male child often results in large families. Thus, if the problem of malnutrition has to be solved in the region where it is most rampant, social engineering will have to be done to correct the attitudes and behaviours prejudicial to women, apart from other developments like improving food and nutrition security, purchasing power, educational levels, particularly of the female and health infrastructure.

The social practice of adolescent marriages followed by adolescent pregnancy prevents a girl from attaining her genetic potential for growth. Teenage pregnancy has been referred to as the worst form of child labour. Cephalo-pelvic disproportion in these young mothers is an important cause of obstructed labour, and maternal and child death.

Maternal malnutrition and low weight gain during pregnancy

Maternal malnutrition is one of the major causes of low-birth-weight babies. Nutrition has a role even in factors like infection and toxæmia. Small stature (height) is an indicator of chronic malnutrition. The incidence of malnutrition among girls or adult women as judged by body mass index (BMI; kg/m²) is higher in South Asia than any other region (Table 1)⁸. The incidence of anaemia, particularly in pregnant women (and children), is also highest in South Asia (Figure 2)⁶.

In South Asian countries, weight gain during pregnancy is only about 5 kg, against the desirable weight gain of 10 kg^{8,9}. While the African societies are not particularly protective of women, Asian societies are more male-centric. Apart from poverty and inadequate household food and nutrition security, several false beliefs and

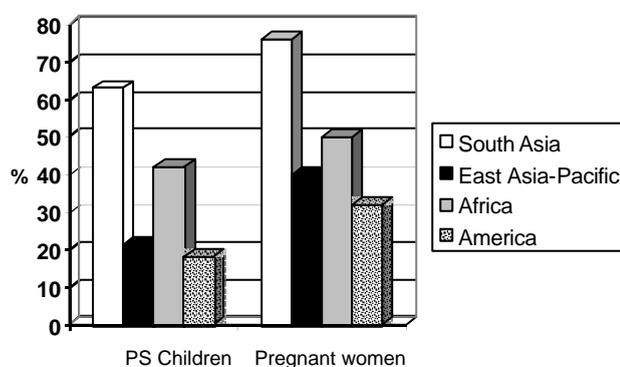
Table 1. Percentage prevalence of malnutrition in women (after Underwood⁸)

Region	BMI < 16 (severe under-nutrition)	BMI < 17.0 (Moderate + severe)	BMI < 18.5 (Mild + moderate + severe)	BMI > 30 (Obese)
Global	2.71	6.4	15.4	9.8
Sub-Saharan	0.1–2.1	0.4–3.1	8–20	0.6–19.4
South Asia	9.5	13.5	28.3	2.0

Table 2. Comparison between countries of South Asia – select parameters of development

Parameter*	Bangladesh	India	Pakistan	Sri Lanka
Malnutrition in < 5 years children (%)	56	53	26	34
Low birth weight (%)	30	33	25	34
Infant mortality rate	58	70	84	17
< 5 mortality rate	89	98	112	19
Maternal mortality rate	440	410	–	60
GNP	370	450	470	820
Adult literacy (%)	56	58	45	90
Female literacy as percentage male literacy	76	62	58	96
Percentage population using adequate drinking water sources	97	88	88	83
Percentage population using adequate sanitation facilities	44	31	61	83
Percentage immunized (BCG, DPT, polio)	69	69	58	99
Crude birth rate	28	25	35	18
Per capita energy availability ^a	2050	2466	2447	2314
Percentage energy from animal products ^a	3.4	7.4	15.5	6.6
Anaemia in pregnant women, % prevalence ^a	77	87	45	58
Anaemia in preschool children, % prevalence ^a	69	56	65	45
Vitamin A deficiency in preschool children, % prevalence ^a	0.8	0.7	0.2	0.6

*Ref. 5; ^aTontisirin *et al.*¹⁰.

**Figure 2.** Anaemia in children and pregnant women (after Singh⁶).

food taboos work against nutrition of pregnant and lactating women, as well as children.

Faulty feeding practices and taboos

In India, pregnant women often eat less (when they need to eat more) for the fear of the baby becoming too big and causing problems during labour. This fear is understandable, since most Indian women have a small stature and untrained birth attendants often conduct deliveries.

Pregnant women are denied good food due to false beliefs. Papaya, a rich source of **β**carotene (vitamin A) is considered to be an abortifacient and is banned. Banana-eating is believed to produce single-child infertility, since the banana tree fruits only once. Though prolonged breast-feeding is routinely done (and needs to be encouraged), it is not initiated within one hour after birth, as is recommended by WHO. Often mother's milk is given only after three days, thus discarding colostrum, which is rich in nutrients like vitamin A and in protective antibodies. WHO recommends exclusive breast-feeding for six months and introduction of complementary food by the sixth month. Neither of these is practised. Pre-lactal foods like honey, other sources of milk, and sugar water are given to the newborn baby, thus causing infection. Complementary food is introduced only after one year, leading to growth retardation.

Comparison among major countries of South Asia

Within the four major countries of South Asia – Bangladesh, India, Pakistan and Sri Lanka, the prevalence of under-5 malnutrition and low birth weight is higher in Bangladesh and India than in Pakistan and Sri Lanka (Table 2)⁵. The incidence of anaemia among pregnant

women is also lower in Pakistan and Sri Lanka than in Bangladesh and India. While Sri Lanka has superior indicators of health (mortality rates) and socio-economic development (literacy, GNP), Pakistan does not, suggesting that the explanation for better nutrition status in Pakistan than in India and Bangladesh may lie elsewhere. It is interesting to note that under-5 and infant mortality rates as well as female literacy as percentage of male literacy are better in Bangladesh than in India. Bangladesh, which at one time was regarded as a basket case, seems to be turning a corner. India comes out poorly even in sanitation, as judged by the number of households with access to waste disposal (toilets); (31 vs 61% in Pakistan; Table 2).

Food security as judged by per capita energy intake is lower in Bangladesh, but comparable in India and Pakistan (Table 2). However, the percentage of calories coming from animal products is much higher (15.5%) in Pakistan compared to the other countries (less than 7.5%; Table 2)¹⁰. This may explain the better nutrition status in Pakistan despite its poor performance in other indicators like literacy, infant mortality and fertility (highest in Pakistan). Better sanitation in Pakistan than in India may also contribute. Pakistan may lose this nutritional edge if it allows its population to grow at the present rate. The better maternal and child nutrition status, and lower incidence of low birth weight in Sri Lanka, despite relatively poor diet, stress the importance of other factors like female literacy, access to healthcare (believed to be better in Sri Lanka), sanitation, etc. in influencing maternal and child nutrition.

Comparison within Indian states

A comparison among three Indian states – Andhra Pradesh, Maharashtra and Kerala – shows that women and children in Kerala have better nutrition status than the other two states (Table 3)⁷, despite comparable or slightly lower intake of calories and other nutrients (Table 4)¹¹. This again can be attributed to the higher degree of social development in Kerala as judged by the level of female literacy⁷, and perhaps better healthcare outreach. The status of women’s empowerment as judged by the percentage of ever-married women involved in making decisions about their healthcare was also higher in Kerala

Table 3. Comparison among select Indian states – percentage prevalence of malnutrition and female literacy (after ref. 7)

Parameter	Andhra		
	Maharashtra	Pradesh	Kerala
Malnutrition in <3 years children	49.6	37.7	26.9
Anaemia in 6–35 months children	76	72.3	43.9
Women with BMI < 18.5	39.7	37.4	18.7
Women with anaemia	48.5	49.6	22.7
Female literacy	55.4	36.2	88.4

(72.6%) compared to the other two states – Andhra Pradesh (56.1) and Maharashtra (49.9)⁷. However, even Kerala cannot be complacent, with almost 27% children suffering from moderate and severe malnutrition. It is interesting to note that despite the low female literacy rate and early marriage, Andhra Pradesh has done remarkably well in fertility control, total fertility rate being 2.32 against Maharashtra’s 2.7 and Kerala’s 2.07 (ref. 7). Impact on nutrition may follow.

The between region, within region and within country comparisons suggest that malnutrition has complex aetiology and only balanced strategy of development ensuring food, nutrition, health and environmental security can help eliminate the burden of malnutrition in the community, particularly in women and children.

The problem of micronutrient deficiency – hidden hunger

In addition to protein–calorie malnutrition, the hidden hunger or micronutrient deficiency is a big problem¹², since the commonly consumed cereal–legume diets are qualitatively poor in micronutrients like iron, zinc, vitamin A and some B-complex vitamins like riboflavin and folic acid. Iodine deficiency is an environmental problem. Consequences of micronutrient deficiency are serious^{3,12,13}.

Marginal malnutrition

Frank malnutrition is only the tip of the proverbial iceberg. For every frank case of nutrition deficiency, there are dozens of others who suffer from sub-clinical malnutrition, which can however leave functional deficits. The cumulative burden of marginal malnutrition in terms of productivity and medical expenditure can be considerable.

Consequences of low birth weight

Infant mortality is higher among babies born with low birth weight. Perinatal death (death within the first week of birth, including stillbirth) and neonatal death (death within the first month of all live births) contribute to 60–

Table 4. Comparison among Indian states – dietary intake 1996–97 (after ref. 11)

Dietary intake	Maharashtra	Andhra Pradesh	Kerala
Energy	2980	2161	2106
Protein (g)	56.1	51.6	56.4
Calcium (mg)	555	418	728
Iron (mg)	17.6	10.4	12.8
Vitamin A	220	278	274

70% of infant mortality (death within the first year). Perinatal and neonatal mortality is estimated to be 6–10 times more in infants born with low birth weight. By preventing such early infancy deaths, considerable reduction in infant and child mortality can be achieved. High infant mortality prompts parents to have more babies, to ensure that at least some children survive. This in turn not only perpetuates maternal malnutrition but also has adverse demographic impact.

Babies born with low birth weight tend to have slower growth rate and stunting, unless there is early intervention. Stunting has adverse effects on physical and mental performance. Daughters who have suffered intrauterine malnutrition are more likely to give birth to low-birth-weight babies – a multigenerational insult.

Foetal origins of adult diseases

According to Barker¹⁴, slow growth *in utero* and during infancy permanently changes the structure and function of the body. Such people suffer from altered regulation of glucose metabolism, raised blood pressure and altered liver function. He further cautions that small size at birth and accelerated childhood weight gain increase the risk of cardiovascular disease in later life¹⁴. Prevention of the rising epidemic of type-2 diabetes and cardiovascular disease depends on (i) promoting foetal growth by protecting the nutrition and health of girls and young women, (ii) protecting growth in the first year after birth and (iii) preventing rapid weight gain in early childhood. Despite smaller babies, Indians have a propensity for adiposity and its central distribution, as well as hyperinsulinaemia from birth ('thin-fat baby syndrome')¹⁵. These are known risk factors for diabetes and cardiovascular disease. Thus developing countries, which are in transition, could face a double whammy of pre-transition and post-transition diseases.

If a beginning has to be made to improve the health status, it should be with attention to health and nutrition of women throughout their life, beginning with the girl child, through adolescence and adulthood.

The three 'A' approach to combat malnutrition

Malnutrition can be combated using the three 'A' approach – awareness, access and affordability.

Awareness

Awareness has to be created not only in the community, but also among the providers – politicians, bureaucrats, NGOs, and medical and agricultural professionals. Innovative methods of creating awareness in the community are needed. The media and school education can play an

important role. The recent initiative of the FAO-lead partnership towards educating school children through the 'Feeding Minds and Fighting Hunger' project is noteworthy, and should be promoted in rural and urban schools. Here, school children are taught to ask questions regarding the 'how and why' of hunger, through a set of lessons in which the teachers are trained. Yet another innovative approach is participatory learning from 'positive deviance'. Within a community there are children who thrive despite adversity. What distinguishes the mothers of such children? Learning through experience-sharing with those mothers can help other mothers in the community.

India needs to put a system of nutrition monitoring and surveillance in place, with mechanisms for feedback to the community.

Access and affordability

Most countries, including India have special nutrition programmes which improve access to food and nutrition among the vulnerable groups. These include: (i) supplementary feeding programmes for vulnerable groups, (ii) distribution of micronutrients like iron, folic acid and vitamin A and (iii) food fortification. Global studies have shown that supplementary feeding programmes make an impact on child nutrition, only if a strong educational component for mothers is built into it¹. Food fortification is more cost-effective than distribution of micronutrient tablets. However, the latter is needed where the problem of micronutrient deficiencies (anaemia and vitamin A deficiency) is severe. Administrative and logistic failures have often brought micronutrient supplementation programmes in disrepute. Where efficiently implemented, they do make an impact.

Ultimately, effort has to be made to enable the community to feed itself. A well-oiled, targetted public distribution system (PDS) can go a long way in meeting the food needs of the poor. Apart from cereals, PDS should also include millets, pulses, oil and if possible some vegetables, fruits, and animal products (milk, eggs, fish powder) to ensure dietary diversification.

Access to a balanced and diverse diet to ensure food and nutrition security at the household and individual levels can be greatly improved by decentralized production of a variety of foods (cereals, millets, pulses, vegetables, fruits and animal products) at the block or village level. Think globally, but plan locally. Homestead gardening, dairy, poultry, fish ponds, village grain-banks, seed banks, nurseries, etc. are the various components to achieve this. Commercial production of region-specific food and non-food items can go on simultaneously. Such people-centric planning can increase household nutrition security and not just national food security, and also generate livelihood, particularly for women. Having enough

food grains in godowns does not ensure household food security, and definitely not nutrition security, which means balanced diet inclusive of macro- and micronutrients. It has been found that within a household, diet of preschool children is deficient compared to that of adults¹¹, suggesting that it is not just affordability, but also the knowledge of a child's nutritional needs and feeding.

Health and environmental security

Without healthcare, sanitation and safe drinking water, food and nutrition security will make little impact. In a vast country like India, healthcare outreach can be improved through village-level paramedics and trained birth attendants. Backup support from the government or private hospitals is needed to ensure proper functioning of such paramedics. The author is currently experimenting with village health and nutrition entrepreneurs and mobilizers in a few villages of the Medak District in Andhra Pradesh, with encouraging results. There are numerous success stories. The Anganwadi workers can be trained as health and nutrition entrepreneurs who can advise mothers on health and nutrition, ensure antenatal check-up and care, treat minor ailments by charging for the drugs, and ensure referral of at-risk cases. They can also maintain records of death with age and cause, and birth with birth weight.

Need for paradigm shift

According to Gopalan¹⁶, there is need for paradigm shift in objectives from:

- Child survival to child health.
- Food security to nutrition security (household and individual), and
- Literacy to education and skill development for women.

To this list can be added:

- Focus only on pregnant and lactating women to life-cycle approach, including girl children, adolescents and elderly people.
- Aid to empowerment through livelihood security for women.

To achieve this, a concerted multi-sectoral approach as envisaged in the nutrition policy document of the Tenth Plan is needed¹⁷. Let this not be just a paper-exercise.

1. World Health Organization, Reducing risks, promoting health, World Health Report V, 2002, chapters 4 and 5.
2. Ezzati, M. *et al.*, Selected major risk factors and global and regional burden of disease. *Lancet*, 2002, **360**, 1347–1359.
3. Bamji, M. S. and Lakshmi, A. V., Less recognised micronutrient deficiencies in India. *NFI Bull.*, 1998, **19**, 5–8.
4. Ramalingaswamy, V., Jonsson, U. and Rhode, J., The Asian Enigma. The progress of nations, UNICEF, 1996, pp. 11–17.
5. UNICEF, Statistical Tables, The State of World's Children, 2001.
6. Singh, R. B., Science for sustainable food security, nutritional adequacy, and poverty alleviation in the Asia-Pacific region. In MSSRF-FAO expert consultation on science for sustainable food security, nutritional adequacy and poverty alleviation in the Asia-Pacific region, MSSRF, Chennai, 2001, pp. 20–78.
7. Report, India-National Family Health Survey (NFHS-2), International Institute of Population Sciences, Mumbai, 1998–99.
8. Underwood, B. A., Health and nutrition in women, infants, and children: Overview of the global situation and the Asian Enigma. In Indo-US Workshop on Nutrition and Health of Women Infants and Children. *Nutr. Rev.*, 2002, **60**, S7–S13.
9. Ramachandaran, Prema, Maternal nutrition-effects on fetal growth and outcome of pregnancy. In Indo-US Workshop on Nutrition and Health of Women Infants and Children. *Nutr. Rev.*, 2002, **60**, S26–S34.
10. Tontisirin, K., Nandi, B. and Bhattacharjee, L., Status of food and nutrition security in Asia and the Pacific region. In MSSRF-FAO expert consultation on science for sustainable food security, nutritional adequacy and poverty alleviation in the Asia-Pacific region, MSSRF, Chennai, 2001, pp. 91–120.
11. Report, National Nutrition Monitoring Bureau, National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, 1999.
12. Kapil, U. and Bhavna, A., Adverse effects of poor micronutrient status during childhood and adolescence. In Indo-US Workshop on Nutrition and Health of Women, Infants and Children. *Nutr. Rev.*, 2002, **60**, S84–S90.
13. Viteri, F. E. and Gonzalez, H., Adverse outcomes of poor micronutrient status in childhood and adolescence. In Indo-US Workshop on Nutrition and Health of Women, Infants and Children. *Nutr. Rev.*, 2002, **60**, S77–S83.
14. Barker, D. J. P., Preventing the global epidemic of diabetes—never too early, never too late. In IX Asian Congress of Nutrition, Symposium, Abstr., New Delhi, 23–27 February 2003, p. 42.
15. Yajnik, C. S., Fetal origins of insulin resistance and cardiovascular risk in developing countries. In IX Asian Congress of Nutrition, Symposium, Abstr., New Delhi, 23–27 February 2003, p. 42.
16. Gopalan, C., Changing nutrition scene in South Asia. In IX Asian Congress of Nutrition, Plenary Session 1, Abstr., New Delhi, 23–27 February 2003, p. 1.
17. Government of India, Planning Commission, Report of the Steering Committee on Nutrition for the X Five Year Plan (2002–2007), September 2002.

Received 27 May 2003; accepted 9 July 2003